Express Mail # EU887664484US **Attorney Docket: TOPP-P7.1-US**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

OF

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TITLED

APPARATUS FOR ERADICATING PESTS

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CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit under any applicable U.S. statute, including 35 U.S.C. §120, of U.S. Patent Application No. 10/145,184, filed May 14, 2002, titled APPARATUS AND METHOD OF ERADICATING PESTS to Daniel P. Topp; and also claims the benefit under any applicable U.S. statute, including 35 U.S.C. §119(e), of U.S. Provisional Patent Application No. 60/291,407 filed May 16, 2001, titled PORTABLE HEAT-TREATING DISINFESTATION APPARATUS.

U.S. Patent Application No. 10/145,184, filed May 14, 2002, and U.S. Provisional Patent Application No. 60/291,407, filed May 16, 2001, are hereby incorporated by reference as if fully set forth herein.

FIELD OF THE INVENTION

The present invention relates generally to an apparatus for heat-treating wood and, in particular, an apparatus and system for disinfesting a large number of wood products by raising the temperature of the wood products to a specified temperature for a specified period of time.

BACKGROUND OF THE INVENTION

A primary method of treating wood and wood products in order to remove pests was fumigation. The fumigation process consisted of placing the wood products in an enclosed volume and flooding the volume with a hazardous airborne chemical capable of killing pests.

The most commonly used chemical to fumigate such wood products is methyl bromide. These fumigation techniques have the potential of endangering human operators who worked nearby and polluting the environment.

The European Union (EU) has decided to prevent the introduction of the pests into the European continent. In order to achieve this goal, the EU has adopted measures requiring the treatment of all wood and wood products including non-manufactured wood packaging (NMWP).

The recently adopted measures by the European Union allow three treatment options for NMWP, namely, heat treatment, fumigation, or chemical pressure impregnation. Although, the EU measures do not call for a specific chemical for use in fumigation or chemical pressure impregnation, individual EU countries may ban the importation of NMWP that have been treated with specific chemicals.

The International Plant Protection Convention has adopted an international standard very similar to those of the European Union that applies to all NMWP, coniferous and hardwood. (The International Plant Protection Convention is recognized by the World Trade Organization as the official international plant protection organization.) The standard currently lists heat treatment as the only "long term measure" to destroy the pests in wood.

The heat treatment measure is less dangerous to workers conducting the treatment and safer for the environment when compared to fumigation or chemical pressure impregnation treatments. Also, in the United States, the Environmental Protection Agency (EPA) is

responsible for registering and establishing technical specifications for pesticides. All fumigants are restricted-use pesticides and they may only be purchased and applied by licensed commercial pesticide applicators. Although it is a violation of Federal law for commercial applicators to apply a pesticide in a manner inconsistent with the EPA label, it is the State, not the Federal government, that licenses commercial applicators.

Environmental concerns also arise in connection with the large-scale use of pressure-impregnated wood. For example, the Netherlands has recently prohibited the commercial importation of wood impregnated with copper compounds because of environmental issues. Like fumigants, pressure impregnation chemicals are regulated by the EPA and may only be used by commercial applicators that are licensed by state governments. Therefore, U.S. companies that use wood pallets or NMWP to export goods must deal with a myriad of different agencies if they intend to fumigate or chemically impregnate NMWP.

SUMMARY OF THE INVENTION

The present invention is an apparatus and system for disinfesting a large number of items by raising the temperatures of wood and wood products to a specified temperature for a specified period of time. The items are usually non-manufactured wood and/or non-manufactured wood products.

The apparatus is designed to eradicate pests from both non-manufactured wood and non-manufactured wood products. The apparatus includes an insulated or non-insulated enclosure

having a first end, a second external end, a second interior end, a left wall, a right, a rigid basal structure, a primary floor, a sub-floor, an interior ceiling, an interior sub-ceiling, a means for evenly heating the interior of the enclosure and a means of recirculating the air in the enclosure in order to evenly treat the products within the enclosure.

A pair of doors allow ingress to and egress from the interior of the chamber. The doors are positioned at the first end of the chamber.

The apparatus also includes means for heating the interior of the chamber and a means for circulating the heated air. The heating means is preferably mounted at the second end of the chamber between the second interior end and the second external end.

The recirculation means includes the ceiling/subceiling assembly (referred to as a ceiling air plenum) and floor/subfloor assembly (referred to as a floor air plenum). The interior ceiling and the interior sub-ceiling, and the floor/subfloor are uniquely designed to control the flow of air within the chamber. The means for re-circulating the heated air within said interior of said chamber communicates with the heating means. The floor air plenum runs the entire length of the interior floor, and consists of perforated floor sections that form the primary floor.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing summary, as well as the following detailed description, may be better understood when read in conjunction with the accompanying drawings, which are incorporated in and form a part of the specification. The drawings serve to explain the principles of the

invention and illustrate embodiments of the present invention that are preferred at the time the application was filed. It should be understood, however, that the present invention not limited to the precise arrangements and instrumentalities shown.

Figure 1A is a perspective view of an apparatus for eradicating pests in accordance with the principles of the present invention;

Figure 1B is a front (or first end) plan view of the apparatus illustrated in Figure 1A;

Figure 2A is a rear (or second end) perspective view of the apparatus illustrated in Figure 1A;

Figure 2B is an opposite side perspective view of the apparatus illustrated in Fig. 2A with a rear door open;

Figure 3A is a perspective view of the apparatus illustrated in Figure 1A showing a forklift loading the interior with pallets;

Figure 3B is a perspective view of the apparatus illustrated in Figure 3A showing a full interior after the forklift has finished loading the last product cart;

Figure 4A is a perspective view of the apparatus illustrated in Figure 3A without the fork- lift present;

Figure 4B is a perspective view of the apparatus illustrated in Figure 3B showing a full interior without the fork- lift present;

Figure 5A is a rear (or second end) plan view of the apparatus illustrated in Figures 1A and 2A with the rear doors removed;

Figure 5B is a top cutaway view of the interior of the apparatus illustrated in Figure 1A;

Figure 6A is an enlarged perspective view of a product cart used in assisting the loading and unloading of the chamber;

Figure 6B is a bottom plan view of the product cart illustrated in Figure 6A;

Figure 7A is a front plan view of the apparatus illustrated in Figure 1A with the doors open;

Figure 7B is an enlarged plan view of a product cart wheel and rail taken at circle 7B of Figure 7A;

Figure 8 is a cross-sectional view of the primary floor in the interior of the apparatus of Figure 1A;

Figure 9A is a perspective view of a perforated floor section which makes up the primary floor in the interior of the chamber;

Figure 9B is an enlarged width-wise cross-sectional view of the perforated floor section illustrated in Figure 9A taken along line 9B-9B;

Figure 10A is a longitudinal cross-sectional view of the apparatus shown fully loaded with pallets, illustrating one example of the direction of air circulation inside the housing;

Figure 10B is a longitudinal cross-sectional view of the apparatus illustrating another example of airflow within the chamber;

Figure 11 is a perspective view of the apparatus illustrated in Figure 1A attached to a wheel/trailer assembly exhibiting the portability of the apparatus;

Figure 12A is a perspective view of standard trailer box which can be adapted to produce an apparatus in accordance with the present invention; and

Figure 12B is a perspective view of the standard trailer box of Figure 12A mated to a standard trailer assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In describing a preferred embodiment of the invention, specific terminology will be selected for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

Certain terminology is used in the following description for convenience only and is not limiting. The terms "right", "left", "front", "rear", "outer" and "inner" designate relative directions to which reference is made with respect to the observer's relative position while viewing certain drawings. The terminology includes the words above specifically mentioned, derivatives thereof and words of similar import.

Preferred embodiments of the present invention will now be described in detail with reference to the accompanying drawings in which an apparatus for eradicating pests in accordance with the principles of the present invention is generally indicated at **10**.

Referring to Figure 1A, the outer housing **12** is illustrated. The housing **12** has a front or first end **14**, a rear or second external end **16**, an external roof **13** and a rigid base structure **15**. The interior volume of the housing is usually referred to herein as the chamber.

The front end **14** of the chamber may be closed off from the outside by a pair of front doors as is illustrated in Figure 1B. A rectangularly-shaped left door **17** of substantially equal width and height (in one embodiment) as a right door **18** are used to close off the front end of the apparatus. Each of the doors **17, 18** may swing on a plurality of individual hinges or on elongated piano hinges. One or both doors may have a handle **20** and a locking mechanism (not shown).

The doors **17, 18** are preferably insulated. Further, a gasket around the perimeter of each door will reduce the likelihood of heat escaping from the chamber.

As illustrated in Figure 1B, the apparatus **10** has a left external wall **22** and a right external wall **24**. The walls are preferably insulated to ensure a more uniform temperature gradient within the chamber.

The rear or second end **16** of the apparatus **10** is illustrated in Figures 2A and 2B. A control panel **48** is shown in Figure 2A. The control panel **48** houses the circuitry to control the heating means **52**. In one embodiment, waste gases created as a by-product of the burning of fossil fuels by the heating means **52** are allowed to escape through port **53**.

Left rear door **42** and right rear door **43** provide access to a heater compartment **39** in which the heating means **52** is located. The rear doors **42, 43** may each have one or more

ventilation grills **47** therein. The rear or second external end **16** of the apparatus with the doors **42, 43** removed is illustrated in Figure **5A**. A heating means **52** is the device used to heat the air inside the chamber and provides the necessary heat to treat the wood products stored within the chamber. The heating means **52** may be a heater that utilizes electric, gas, oil, wood or other fossil-based fuel. The size (i.e., btu output) of the heater **52** depends on the volume of the chamber and the type of products to be heat-treated.

Referring to Figures 5A and 5B, the sub-floor **70** is below a primary floor **50**. The sub floor **70** extends -- at least partially -- under the heater compartment **39**. Primary floor **50** has a plurality of perforations, the purpose for which, will be more fully described hereinafter.

The subject apparatus **10** may be used to eradicate pests from a variety of products. Although a number of products (e.g., machinery, food products or other staples, etc.) may be treated by the subject apparatus **10**, it is especially well-suited for heat-treating wood products.

Common non-manufactured wood products that the present invention may be particularly adapted to heat-treating are wooden pallets and shipping materials. Accordingly, the present invention is illustrated in various figures as being loaded with wood pallets **98**. Other non-manufactured wood products can be handled and treated in a similar manner.

Referring now to Figures 3A and 3B, the apparatus **10** may be loaded (in this example with wood pallets **98**) through the use of a forklift **99**. In this embodiment, left door **17** and right door **18** are opened to allow ingress into and egress from the interior of the apparatus **10**.

Referring to Figures 4A, 4B and 5B, elongated internal rails **25, 26** are positioned above the primary floor of the interior of the housing. In a preferred embodiment, the internal rails **25, 26** are welded to the inside of the rigid basal structure **15**. If an unusually heavy load is routinely treated in the chamber, legs may be added to help support the rails. The elongated internal rails are designed to support and guide a product cart **30**. (See Figures 6A and 6B.)

A left rail external extension **28** and a right rail external extension **29**, as illustrated in Figures 3A, 3B, 4A, 4B and 5B, assist in supporting the product carts **30** as the apparatus is being loaded and unloaded. The left rail external extension **28** releasably connects to and is directly aligned with the elongated internal rail **25**; similarly, the right rail external extension **29** releasably connects to and is directly aligned with the elongated interior rail **26**. The external rail extensions **28, 29** are removed and stored when not in use.

Referring again to Figures 4A, 4B, 6A and 6B, the pallets **98** and/or wood products are actually placed on product carts **30**. The product carts **30** have a rigid frame **56** to support the products to be heat-treated. The frame **56** is preferably rectangular in shape with the longitudinal dimension corresponding roughly to the width of the chamber. A guide wheel **27** is located preferably at each of the four corners of the frame **56**. The guide wheels **27** are designed to roll on the rail external extensions **28, 29** and the elongated interior rails **25, 26** in the chamber. The product cart and rail system greatly assist the loading and unloading of wood products to be heat-treated in the chamber.

In one embodiment, each product cart **30** has a width almost as wide as the width of the chamber. The length of the housing depends on a number of factors; for example, some of the factors to be considered are the area on which the apparatus will be situated, the number of wood products to be treated during one cycle, the dimensions of the wood products to be treated, the mass of the wood products to be treated, etc.

Although the various figures show the cart **30** holding two stacks of pallets, one skilled in the art, after reading this disclosure, could readily adapt the length, width and height of the various elements (chamber, cart, etc.) to accommodate a desired number, type and size of products to be treated. The product carts **30** are designed to be loaded by a human or mechanical power. The carts may also be pushed into or pulled out of the chamber by a person. In another embodiment, the primary floor of the chamber may be reinforced to allow a forklift or other machinery to be brought into the chamber to lift, move, load or unload a particularly heavy or unwieldy load.

Referring again to Figures 6A and 6B, guides **55** are designed to accommodate the forks or prongs of the fork lift **99**. A plurality of ventilation holes **59** are designed to allow the maximum amount of air to circulate up to the products carried on the carts **30**.

Referring now to Figure 8, a cross section of the primary floor **50** of Figure 5B is illustrated. A bottom or floor plenum **40** is formed between the sub-floor **70** and the primary floor **50**. The floor plenum **40** allows heated air to travel underneath the entire length of the chamber as will be described in further detail hereafter.

Referring now to Figure 10A, and 10B ceiling plenum **68** is formed between a sub-ceiling **69** and a primary ceiling **74**. The sub-ceiling **69** is made of a substantially flat sheet and stretches across the entire width of the chamber. The sub-ceiling starts from the back wall of the chamber **76** and extends a portion of the way towards the front end **14** of the apparatus. In a preferred embodiment, there are no perforations in the sub-ceiling **69**.

Referring now to Figure 9A, a perforated floor section **62** is shown. A plurality of perforated floor sections **62** are installed in the chamber to form the primary floor **50**. The floor sections **62** are perforated in order to allow the heated air to pass from the floor plenum **40** to the product carts **30** and eventually to the products **98** stored on the product carts **30**. Figure 9B is a cross-section of the perforated floor section in Figure 9A. The length and width of each perforated floor section **62** are relatively unimportant. However, it may be preferable to size each floor section **62** in order for them to be easily moved and lifted by one individual.

Referring again to Figure **5A** an enlarged view of the heater compartment **39** is shown. As stated previously, a forced air heater may be used for the heating means **52** in one embodiment. However, one skilled in the art, after reading this detailed description could readily adapt or substitute other heating means for the forced-air heater. For example, the heating means **52** may be a direct fired heater, either electric or fossil fuel, or an indirect fired heater.

In one embodiment, an exhaust stack **54**, connected to port **53** provides a path for the waste gases and combustion by-products generated by the heating means **52** to escape.

Figures 10A and 10B are longitudinal cross-sectional views of the chamber and include a flow diagram illustrating the path of the air flow within the chamber. The fan assembly **71** circulates through heater **52**. In one embodiment the floor plenum **40** is designed to communicate with the output of the heater **52** so that hot air is forced into the floor plenum **40**; the hot air rises up through the perforations **63**, **65** in the floor sections **62**, through the pallets and returned via the ceiling plenum **68**.

In the embodiment illustrated in Figure 10A, the forced heated air travels below the perforated floor sections **62** of the chamber. In the embodiment illustrated in Figure 10A, the floor plenum **40** is designed to deliver air under the entire floor of the chamber. Since the perforated floor is made up of a plurality of perforated sections **62** having regularly-spaced openings (see Figure 9A), the heated forced air rises, travels amongst the products and into the ceiling air plenum **68** which directs the air back to the heating means **52**.

In the embodiment illustrated in Figure 10B, the circulation of the air flow is reversed and forced heated air travels through the ceiling plenum **68**; the heated air is then drawn substantially evenly through the pallets, through the perforated floor sections **62** and into the floor plenum **40** to be recirculated by the heater **52**.

Although the openings in the perforated floor sections **62** are equally-sized and equally - spaced, in one embodiment, the size and spacing of the openings may be varied to ensure that substantially equal air flow passes amongst the products. For example, the perforated floor

sections **62** closest to the second end **16** of the chamber may have less openings and/or be spaced further apart than the openings in the perforated floor sections **62** closest to the first end **14**.

The sub-ceiling **69** that forms the ceiling air plenum is about three-quarters of the length of the chamber in one preferred embodiment. The length of the sub-ceiling **69**, and the shape and number of perforations **63** and **65** in the floor sections **62** ensure that forced hot air moves evenly amongst each stack of products **98.** Therefore, the design of the floor plenum, the ceiling plenum and the floor sections **62** ensure that all products **98** within the chamber reach the minimum temperature for the minimum period of time, thereby assuring that the international heat treatment standard can be achieved.

Similarly, in embodiment 10B, the design of the floor return air plenum and ceiling supply plenum ensure that all products **98** within the chamber reach the minimum temperature for the minimum period of times thereby assuring that the international heat treatment standard can be reached.

Tests have proven that the subject apparatus keeps a relatively even temperature distribution throughout the entire chamber without significant hot or cold spots. The present design ensures targeted pests are destroyed and the products are heat-treated properly in a relatively efficient manner without degrading the quality of the products being treated.

In the preferred embodiment a microprocessor based controller can automatically manage the heat treatment process. In this preferred embodiment, a computer is connected to the control panel **48**. The control panel **48** communicates with one or more temperature sensors in

the chamber in order to control the on/off cycles of the heater **52** and fan assembly **71**. By inputting certain parameters, the interior of the chamber can be maintained at a specific temperature for a specific period of time.

Referring now to Figure **11,** the chamber may be mounted on wheels **97** for moving the chamber to a particular location. A tractor, truck or other towing vehicle (not shown) may be used to pull the apparatus **10**. Posts **96** allow the apparatus **10** to be self-supporting when a truck or other vehicle is not present. The system, as shown in Figures 12A and 12B, can be constructed from an insulated or non-insulated commercial trailer.

The wheels **97** and posts **96** many be removed, and stored for later use, if the apparatus will be stationed at a particular location for an extended period of time.

Although this invention has been described and illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made which clearly fall within the scope of this invention. The present invention is intended to be protected broadly within the spirit and scope of the appended claims.

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